35/4 November 1969

Two floods
Tennessee, Virginia

Soil information for land use planning

Soil Conservation Service
U.S. Department of Agriculture

Soil Conservation

Devoted to the wise use of land and water resources

November 1969 Vol. 35, No. 4

Soil Conservation

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Floods . . .

Our meager beginnings at flood-prevention work were tested critically by two once-in-a-century-plus rains that struck sections of Appalachia last summer.

In the midst of a three-county area in Tennessee in June one small watershed with a nearly complete PL-566 Project withstood an 8-inch rain with minor damage. Across the ridge, a similar watershed counted two lives and $2.3 million lost.

Before the waters receded, SCS watershed specialists were on the ground to document the event, with Audio-Visual Chief Joe Larson there to help record the story (p. 75).

A couple of months later, Hurricane Camille deluged the headwaters of the Potomac and James rivers. Information Specialist Bernie Roth and Virginia Watersheds Leader John Abernathy toured the area to give us an appraisal (p. 78) of our flood-prevention work in the Potomac Basin.

Urban hydrology

It doesn't take a hurricane to make a flood in paved and graded urban areas, as many communities are learning to their sorrow. Soil and engineering knowledge are combined in our center-spread article (p. 83) to explain what happens to the hydrologic regime when land is converted from farm to urban uses.

Planning maps

SCS offers a significant new service to land use planners in the intermediate-scale national soil map (p. 80) now being started with coverage of the urbanizing east coast.

COVER: The solid pattern of impervious housetops, streets, and graded yards contrasts strikingly with the absorptive forest cover replaced by a residential development in New Jersey.

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A tragic contrast . . .

Two small watersheds in a Tennessee storm

Early the morning of June 23 north central Tennessee was struck by a record thunderstorm which dumped 8 to 9 inches of rain on the area in 6 hours.

The intensive rains rushed down the steep Cumberland Mountain foothills and turned small placid tributaries in Macon, Clay, and Jackson counties into raging flood threats.

Hard hit were two adjoining watersheds—Salt Lick Creek and Jennings Creek.

In the unprotected watershed of Salt Lick Creek the flood threat became a tragic reality—two lives lost, $2.3 million damage to the community of Red Boiling Springs alone, plus hundreds of thousands of dollars damage to roads, bridges, and cropland throughout the rest of the watershed.

Jennings Creek watershed residents, protected by a virtually completed watershed project, suffered an estimated $200,000 in damages but escaped more than $1 million in damages due to the flood-retarding dams that had been built under the Public Law 566 small watershed program.

The two watersheds—with similar characteristics — received approximately the same amount of rain over the same period. The only difference was watershed protection, thus providing a convincing example of the effectiveness of the small watershed program.

The 10 earthen dams in the Jennings Creek Watershed Project kept an estimated 5,000 acre-feet of water—6.8 million tons—from inundating the valley. Water cascaded over the emergency spillways of eight of the dams for up to 9 hours after the rains stopped. Yet damage

A Red Boiling Springs home, swept off its foundation by floodwaters, finally came to rest against filling station pumps.

to the structures was slight. During this single storm the watershed dams prevented enough damage to pay nearly one-third of the project's total cost.

Back in 1946 a less intense storm dumped 6 inches of rain in 24 hours on the 46,000-acre watershed. The resulting flood took the lives of six people, three of whom lived in the little community of North Springs. Damage to crops, buildings, roads, bridges, and livestock in the watershed was very extensive.

This year North Springs virtually escaped damage. Luster S. Cassetty, president of the Jennings Creek Watershed District and resident of North Springs, said, "If the dams above had not been built, we would have left our house and probably would not have been able to return. I think we would have lost the whole thing."

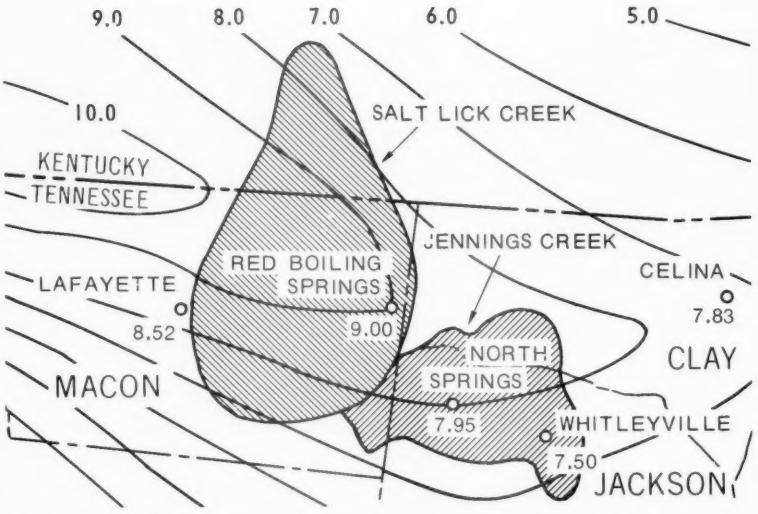
The change in the watershed came about when the soil conservation districts in the three counties and the Jennings Creek Watershed District applied for USDA assistance in establishing a watershed project under Public Law 566. The project became operational in 1958.

Ten of the 12 planned floodwater-retarding dams have been constructed—providing about 82 percent protection to the watershed. Three of the watershed lakes are stocked with fish and provide recreational opportunities for boating, swimming, and picnicking.

One lake and adjacent land were recently purchased by a local manufacturing plant for development as a recreational complex for use by its employees. Biology graduate students from Tennessee Technological University use other watershed lakes as outdoor classrooms. Students from Jackson County High School take field trips throughout the project area periodically.

But on the other side of the divide, the story is one of despair.

Red Boiling Springs, a small resort community, is nestled in the southeast portion of the 75,000-acre Salt Lick Creek watershed. On June



Above, isohyetal map of rainfall of June 23 in the environs of Salt Lick Creek and Jennings Creek watersheds. Below, buses, trucks, cars, 120 vehicles in all, were damaged during storm at Red Boiling Springs.

23 the flash flood causing $2.3 million damage hit the community without warning and with unbelievable force. Swirling waters ripped up large chunks of asphalt pavement and tossed them around like pieces of styrofoam. At least 120 automobiles were turned over, smashed, and swept down stream. An estimated 35 homes and 15 business establishments were moved from their foundations.

The two young girls who drowned were swept away from their mother as she attempted to lead them from their home to safety. The mother clung to a tree branch for 3 hours before she was rescued.

Personal property damage was extremely high. Knee deep mud settled on floors of stores and homes as the water receded.

Willis Knight, the young mayor of Red Boiling Springs, had but one thought when he viewed the damage. That was the small watershed proj-

Above, floodwaters never reached this home in Jennings Creek watershed, but without upstream dams they would have been 5 feet deep. Below, one of the 10 flood-prevention dams in the Jennings Creek watershed pictured before the storm.

ect that the community had been considering for the past 3 years.

"Had those dams been built," he said, "this tragedy wouldn't have happened."

The $2.3 million suffered in Red Boiling Springs was nearly seven times the estimated cost of installing the proposed watershed protection project.

The unprotected watershed is vulnerable to storms of far less magnitude. Floodwater damage to agriculture is estimated to be $54,500 annually. Although considered a moderate loss, the frequency and severity of the floods make it impossible to use the land to its full capabilities.

Nonagricultural damage to Red Boiling Springs amounts to $6,000 yearly. Actual floods occur every 3 to 5 years.

An investigation report made on the watershed in 1967, under the Appalachian Regional Development Act, showed that annual damages could be reduced by at least 70 percent if local people sponsored a small watershed project under Public Law 566.

Community leaders were interested in the project. In addition to flood protection, two of the proposed reservoirs could be developed for municipal and industrial water and recreation uses.

These two measures alone could have added an estimated $86,000 to the community's economy and create an environment attractive to small industry.

But the watershed proposal was turned down because the community couldn't raise the $97,000 needed as its share of the $1 million project.

The tragic flood immediately brought renewed interest in the watershed project. During a special session a week after the storm, Red Boiling Springs' city council unanimously passed a resolution urging USDA's Soil Conservation Service to promptly put into effect that portion of the Salt Lick Creek Watershed Project that would protect the community from future floods.

The resolution stated that the community would be bound and obligated to do everything within its power and financial ability to assist in the construction of the project.

Mayor Knight is convinced that if the four flood-retarding dams had been built upstream from the city, damages would have been drastically reduced. SCS watershed specialists agree. In reviewing the watershed plans, they say the proposed structures would have reduced damages from this particular flood by about 90 percent. ♦

Soil painting creates interest in surveys

Dock J. Polone of Claremore, Okla., has earned the reputation of being a mud dauber, not because he is a soil scientist but because of his hobby of making paintings and artistic displays from soil samples.

The many bright-colored soils found in northeast Oklahoma inspired Polone to use them for painting. He has made colorful, educational displays to create interest in soil surveys.

Polone says that soils can tell their own story and proves it by using their many colors to paint colored general soil maps, conservation scenes, and portraits of people and animals. These sculptured paintings are in semi-relief giving a third dimension. For painting materials he uses finely pulverized soils applied to board with an emulsion of one-half water and one-half glue, which becomes rock-hard upon drying.

A career soil scientist for 34 years, Polone has done all of his soil mapping in eastern Oklahoma. He estimates he has mapped 4,400,000 acres of eastern Oklahoma soils.

Polone relies heavily on his Cherokee Indian ancestry to provide the talent needed for his hobby. —MYRON A. HURD, *district conservationist, SCS, Claremore, Okla.* ♦

Camille and the Potomac

Hurricane whiplash draws attention to basin-wide flood-protection program

This tobacco crop and many others will never be harvested.

The recent whiplash of Hurricane Camille across Blue Ridge country in Virginia was a reminder that protection of Potomac River Basin resources is still unfinished business.

Water and rock cascaded down from the upper reaches of the Potomac and neighboring James River Basins last August 20 to take hundreds of lives and cause more than $150 million in property damage. Dozens of people are still missing and damage to property and crops is still being assessed.

27 inches of rain

In the worst-hit Nelson County and vicinity on the east slope of the Ridge, in the James Basin, virtually nothing except earlier warnings might have diminished deaths and destruction. Here incredible 27-inch rains and landslides caused 200 fatalities.

One reporter wrote, "Rivers and streams have changed their courses. Portions of the brand new (3 weeks old) dual lane section of U.S. Route 29 simply no longer exist. A rock slide at Lowesville covers at least 40 acres . . . and all of this the results of one night's rain!"

Waynesboro, west of the Ridge, had some advantage in 12 floodwater-retarding dams installed in the past dozen years in the South River subwatershed, part of a comprehensive program for the far-flung Potomac Valley. Camille's inch-per-hour torrents of rain did run over emergency outlets of several structures and down other valleys, to make a $2-million sweep through town. But the dams held some 2 billion gallons of floodwater out of urban areas, averting much higher damages and possible loss of lives.

A warning to campers

One of the dams on a South River tributary a few miles upridge from the community was credited with saving 100 campers from injury or death. They were attempting to weather the storm at Sherando Lake recreation area high in the George Washington National Forest. A warning roar of water gushing over the emergency spillway above the campsite at 2 a.m. sent them scattering for higher ground. Except for a good soaking and some damaged or lost equipment at 10 or 12 campsites, they decamped unscathed the following day. Without the dam, a flash flood might have swept many campers into the lake.

Along the little waters

Of the Waynesboro area episodes, Mayor Benjamin Cooper voiced the feeling of many, including hardest hit residents and buinessmen: "It could have been much worse, as it was in many places nearby."

The South River work that helped Waynesboro weather the storm is part of a master program that is only begun in the vast four-state Potomac River Basin.

Along the mainstream and larger tributaries, major works of improvement have reached various stages of design and consideration. Higher in the Appalachian uplands of Virginia and West Virginia, there is visible action of a different sort. The locale consists of little creeks, runs, forks, and rills that feed "the Nation's River."

Here, subwatershed projects that combine structures with coordinated land treatment are modest individually. But collectively, they are designed to relieve water troubles far upstream where floods begin.

Action started in the late 1930's when the Congress authorized the Department of Agriculture to lend special skills to the locality. Cooperating soil conservation districts —the Lord Fairfax and Shenandoah districts in Virginia and the Eastern Panhandle and Potomac Valley districts in West Virginia—launched a massive program to treat the land. For 25 years, the organized landowners have bettered their pastures, contoured their crop fields, reforested hillsides, installed woodland fire-controls, and corrected grazing abuses. These and similar measures now protect thousands of acres. Building of 8,000 farm ponds has multiplied local water sources.

In the mid-1950's, districts and the USDA adopted the broader watershed program, including flood-retarding structures on smaller tributaries.

The Soil Conservation Service teamed with the U.S. Army Corps

Peaceful Lake Sherando, below the watershed dam that gave campers time to get out of the floodwater's path, is a striking contrast to the many flood-littered communities in Appalachian Virginia.

of Engineers in checking potential sites. Their investigations were aided by the districts' landowner-supervisors.

Upstream damsites

In all, they identified 527 acceptable Upper Potomac locations in a comprehensive approach for the basin. Upstream dams are intended to complement major works of flood control and water development planned for downstream areas. Of about 240 sites proposed for Virginia, some 150 are in the Shenandoah Valley area.

Construction is underway along picturesque reaches of the North and South rivers in Virginia; and on South Fork, Patterson Creek, and many other streams of West Virginia.

Masses of earth and rock three times the volume of the Great Pyramid of Egypt have been moved, and 67 flood-retarding dams are completed.

Each has increased the safety of lives and property downstream. Bottom-land farmers, suburbanites, and a growing number of high-cost industrial complexes have felt their benefits. Together, the dams can store more than 9 billion gallons of floodwater to take the sting out of intense storms and snowmelt.

Recent structures have been built to add municipal and agricultural water storage, fish and wildlife, and public recreation benefits to their basic job of flood prevention.

One dam in each state already supplies water as well as protection to its neighboring communities. A dam on the Upper North River in Virginia stores 616 acre-feet for the city of Staunton, and a site on Mills Creek holds 307 acre-feet for suburban Waynesboro. The largest subwatershed structure to date, 100-foot-high Site 14 in New Creek-White's Run watershed, contains water equivalent to a 2-year supply for the city of Keyser, W. Va., and Site 46 on Patterson Creek provides 184 acre-feet for Ft. Ashby.

Water supply a byproduct

Several sites along the fringes of George Washington National Forest have been fully developed for organized camping, boating, swimming, picnicking, and hiking. Many others afford some incidental recreation.

The subwatershed program aims to reduce the rate of upstream flood damages by as much as 60 percent. Basic water-saving measures established by local farmers already have carried them safely through periodic drought. Widespread watershed land treatment—at least 80 percent of it paid out of individual landowners' pockets—tends to offset erosion problems of feverish construction in the metropolitan areas.

Distribution and timing of construction of Potomac upstream structures become increasingly critical. Operations will undoubtedly need to be adjusted to pressures of population as well as phenomena like Hurricane Camille.

That the soil conservation districts and other local interests can cope with such dynamics seems clear. The matter of time—completion date is set for the year 2010—concerns community leaders and agencies alike.

Massive erosion, flooding, and sedimentation continue to plague the District of Columbia area in the lower basin. Upstream in Virginia, the events of the night of August 20, 1969, will haunt the mountain hollows for years to come. ♦

A new soil map of the United States

By Arnold C. Orvedal
Assistant director, soil survey interpretations, SCS, Washington, D.C.

A new national soil map designed specifically to meet the needs of regional land use planners and others concerned with multicounty areas is being produced by the Soil Conservation Service.

The first two sheets, nearing completion, cover the rapidly urbanizing Northeastern States where the demand for soil information to guide land use changes is urgent.

The scale, 1:1,000,000 or about 16 miles to the inch, is intermediate between that of detailed soil surveys currently being published by SCS and the small-scale soil map in the *National Atlas* to be published by the U.S. Geological Survey.

A familiar scale

The resulting maps are comparable in scale to the familiar road maps available in filling stations. The 48 mainland states will be covered on 13 sheets 38 by 48 inches in size.

This is one of the most widely used standard map scales. The World Aeronautical Charts and sheets of the International (geographic) Map of the World are at this scale. Increasingly, maps on other subjects are appearing at this same scale—an obvious convenience to planners and technicians who must consider and integrate information on several subjects for the same area.

One of the important federal series of state base maps is at the scale of 1:1,000,000. A state map at this scale is sufficiently large to show considerable information but not too large for convenient use at a desk. Single sheets accommodate between 50,000 and 200,000 square miles, making this scale one of the best for regional planning.

The smallest feasible delineation represents about 15 square miles of countryside, but most delineations are larger. This minimum on-the-ground area means that the map represents considerable generalization of the kinds of soil and their distribution, which is necessary for it to convey as much information as possible without being a jungle of tiny delineations and symbols.

The map is designed to be the best possible record of our soil resources at the 1:1,000,000 scale. It is intended to serve as a basic technical reference rather than a map for general popular use. It can be used to make other maps showing regional interpretations and supplementary maps designed to meet the specific needs of individual studies.

A basic reference

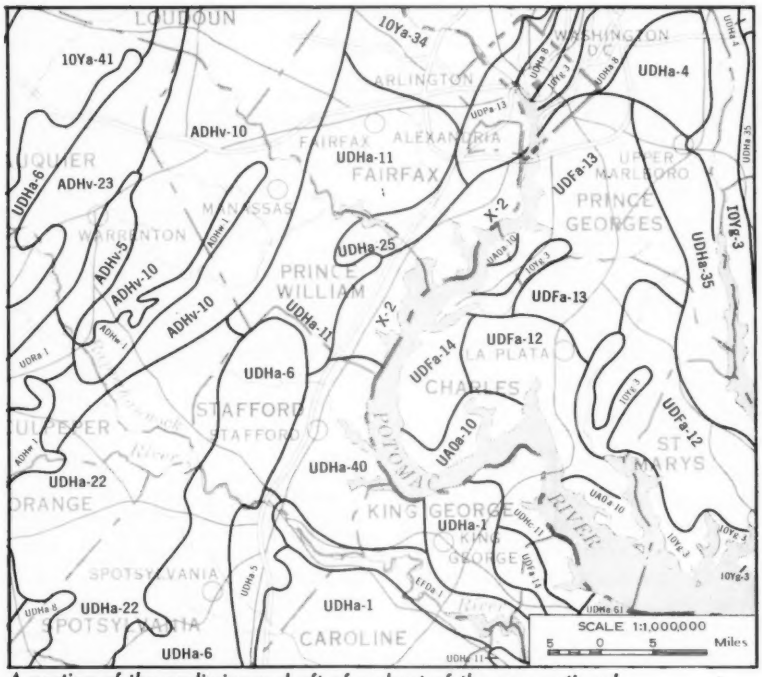
The detail of the classification used on a map is as important as the scale in determining its practicality and usefulness. Soil subgroups (which are just one step above families in the hierarchy of categories in the soil classification system) were chosen as the basic components of the soil associations for the new national map. Subgroups carry enough information that important interpretations can be made. At this level, the number of map units (associations) is between 150 and 200 on a single sheet and between 1,500 and 2,000 for the entire United States.

Although phases of series provide

Legend and Description of Soil Associations Shown on General Soil Map (Scale 1:1,000,000)

Legend		Extent (square miles)	Physiographic setting	Component soils		Depth to bedrock (feet)	Shrink-swell potential	Flood hazard
Map symbol	Map unit name			Name	Percent			
EFDa-1	Typic Udifluvents and Fluventic Haplaquepts, loamy, level	(1)	Floodplains, wet in part, underlain by sediments containing a large component from gneisses, schists, and other rocks containing mica	Typic Udifluvents, loamy, level	70	>10	Low	Severe
				Fluventic Haplaquepts, loamy, level	20	>10	Moderate	Severe
				Other soils	10			
IOYa-34	Typic Dystrochrepts and Typic Hapludults, loamy, sloping	(1)	Moderately dissected uplands underlain by gneiss and schist—Piedmont	Typic Dystrochrepts, loamy, sloping	50	2-4	Low	Slight
				Typic Hapludults, loamy, sloping	35	3-10	Low	Slight
				Other soils	15			
UDHa-22	Typic Hapludults, clayey, sloping, and Lithic Dystrochrepts, skeletal, moderately steep	(1)	Sloping uplands underlain by schists—Piedmont	Typic Hapludults, clayey, sloping	50	>4	Moderate	Slight
				Lithic Dystrochrepts, skeletal, moderately steep	30	<1½	Low	Slight
				Other soils	20			

[1] Data not yet available.



A portion of the preliminary draft of a sheet of the new national soil map, showing Washington, D. C., in the upper right corner, is reproduced here at actual scale, 1:1,000,000. The soil boundaries and symbols are on a new base map for nationwide use being adapted by SCS from manuscript material provided by the U. S. Geological Survey.

the best information for interpretations, a national map in those terms would be unmanageably complex since the number of series in the United States approaches 9,000. Soil families, the next higher category, was rejected for the same reason, plus the handicap of exceedingly long names.

The legend of the map makes use of scientific names of soils, because they convey a great deal of information to those familiar with the soil classification system. Although others may not find them easy to understand, no acceptable substitute has been found for this terminology. The examples of the tables, however, have been prepared so that all who deal with soil resources will find the information meaningful. The tables illustrate the map unit symbols and names along with the kinds of descriptive and interpretive information proposed.

The soil map-unit symbols used in this draft fit into the system developed for technical, small-scale soil maps. The system's advantages compensate in part for the cumbersome length of the names and symbols.

Descriptive mapping

As mapping is extended, new units can be inserted in alphabetic-numerical order. Legend organization can be maintained because map units with the same principal components are kept together. Secondly, the symbols suggest the soil name. After a little practice, users can remember them more easily than if symbols and soil names were unrelated. (All symbols beginning with "U," for example, stand for Ultisols). Another advantage is that the system can be applied nationally.

The map is accompanied by a table describing some major fea-

Selected Interpretations of Soil Associations Shown on General Soil Map (Scale 1:1,000,000)

Map symbol	Component soils	Suitability for— Tilled crops	Pasture	Tree fruits	Timber and pulp wood	Limitations for— Foundations	Shallow excavations	Septic tank filter fields
EFDa-1	Typic Udifluvents, loamy, level	Good	Good	Good	Good	Severe	Severe	Severe
	Fluventic Haplaquepts, loamy, level	Poor	Fair	—	Good	Severe	Severe	Severe
	Other soils							
IOYa-34	Typic Dystrochrepts, loamy, sloping	Fair	Fair	Fair	Fair	Moderate & severe	Moderate & severe	Severe
	Typic Hapludults, loamy, sloping	Good & fair	Good	Good	Good	Slight & moderate	Slight & moderate	Slight & moderate
	Other soils							
UDHa-22	Typic Hapludults, clayey, sloping	Good & fair	Good	Good	Good	Moderate	Moderate	Moderate
	Lithic Dystrochrepts, skeletal, moderately steep	—	Poor	Poor	Fair	Severe	Severe	Severe
	Other soils							

tures of each map-unit and its principal components. This information emphasizes features highly relevant to soil interpretations demanded today for homesite selection and other applications. Perhaps the most useful part of the table sets forth interpretations, such as the soil limitations for foundations, shallow excavations, and septic tank filter fields. Because the map shows basic soil information, additional interpretations can be made by those who are familiar with the soils as indicated by their scientific names.

Generally, the problem of expressing interpretations becomes more difficult as the scale of the map becomes smaller, because the map units become correspondingly less homogeneous. The table is adjusted for this shortcoming in two ways:

(1) Interpretations are given for the individual components of a map unit, rather than for the map unit as a whole. Such treatment is especially important if the components contrast highly, as in the case of UDHa-22 (see table).

(2) The number of rating classes is limited; e.g., slight, moderate, and severe. This means that each class has a wide range; yet not so wide as to make the interpretations too ambiguous for many uses. The interpretation range for some components may need to be indicated by two terms (e.g., "slight and moderate") but usually one term will suffice. The rating terms must be defined as precisely as possible.

The new map and tables will provide a vast amount of practical information to resource planners who must help decide on how our land is to be used around our growing cities and all the countryside between. ♦

Officials speak out on sediment control

Steps that communities must take to deal effectively with the problem of sediment from expanding urban and suburban areas were pinpointed at the National Conference on Sediment Control in Washington, D.C., September 14-16.

Representatives of counties and conservation districts across the Nation joined with state and regional officials and Washington area conservationists to discuss the widely varying problems on sediment in their local areas.

The draft of a publication, "Community Action Guide for Sediment Control," was thoroughly reviewed by participants in workshop sessions. The resulting draft will be published by the National Association of Counties to help local officials deal with their sediment problems.

U.S. Senator Jennings Randolph of West Virginia sounded the conference keynote, naming sediment as "the world's greatest pollutant."

Senator Randolph said that damage caused by sediment is reflected not only in the loss of storage capacity for water supply, flood control, power generation, navigation, and regulation of streamflow for water-quality control, but also in its impact on these facilities for recreation.

"Man now has the power to control many of the elements of Nature," Senator Randolph pointed out. "He can destroy the soil, render air and water unusable through pollution, kill every form of life—himself included."

Some quotes from other speakers:

CARL L. KLEIN, *assistant secretary of Interior for water quality and research:*

As a nutrient carrier, sediment promotes algal growths which degrade water quality and accelerate the aging process of lakes and reservoirs. Dredging requirements and loss of reservoir storage space caused by sedimentation costs this Nation about $225 million annually, and this does not include the loss of topsoil, the severe degradation of water quality, or the damaging effects of sediment pollution on fish and wildlife.

NORMAN A. BERG, *associate administrator, Soil Conservation Service:*

We haven't finished the sediment control job on farm or forest or rangeland by any means. But sediment in suburbia is an increasingly challenging and difficult frontier of conservation.

The modern shopping center using 25 acres of land covers 19 acres with rooftop, blacktop, or concrete, including space for parking, access roads and streets, and curbing. The ability of the remaining 6 acres to absorb water is usually cut way down because of grading, shaping, and other construction operations. A similar situation prevails in a new industrial area, where most of the workers commute by automobile and where modern, efficient materials-handling and processing equipment is used. This mass alteration of land is creating real problems in water control.

ROBERT E. BRENNAN, *former director of the Maryland Suburban Home Builders Association:*

It may take a local crisis before people become aware of the problem, but in any case regulations must be based on economic feasibility as well as environmental quality. They can't be offered to builders on a take it or leave it basis.

LESTER HERR, *chief, Hydraulics Branch, Bureau of Public Roads, U. S. Department of Transportation:*

Fitting roads to existing landscapes reduces the number of cuts and fills as well as the cost of erosion control and longterm maintenance. Highway planners, designers, construction foremen, and maintenance men need to communicate and cooperate more.

Good intentions don't get the job done. It takes manpower to check on the advisability and progress of conservation measures before, during, and after highway construction.

Concrete should be a last resort in dealing with roadside drainage ditch problems.

ALLEN CYWIN, *director, Division of Applied Science and Technology, Federal Water Pollution and Control Administration:*

Utilization of existing techniques and development of new techniques for sediment control that are tailored specifically for use in urban and urbanizing areas are musts if adequate control of sediment problems is to be achieved . . .

A. R. ROBINSON, *research hydraulic engineer and director, USDA Sedimentation Laboratory, Oxford, Miss.:*

Many of the methods used to control sediment on agricultural lands are directly applicable to control of urban sediment, and still others are applicable with some modification. Urbanization usually means that large areas of land are stripped bare and less permeable subsoil is exposed, in many instances for months or even years. In this condition the erodibility of the soil is usually increased many times.

It is important to develop criteria for reformation of drainage systems where the natural system has been altered. Improved bank and surface stabilization methods are needed. After stabilization, new technology is needed to deal with the hydraulic characteristics of the required drainage system. ♦

What urban building does to soil and water

By Charles E. Kellogg and H. C. Enderlin
Deputy administrator for Soil Survey and assistant director of Engineering Division, SCS, Washington, D. C.

The process of reshaping land for urban uses alters soils in many ways, often with drastic effects on drainage, runoff, and streamflow.

With people and industries moving into the country in ever greater numbers, it is not surprising that some developments have difficulties with soil and water problems.

All too often we hear—too late—of a house that cracked up because it was built on a soil that would slide and buckle under the weight; of a local sewage system swamped by poor drainage; of a little stream converted into a raging torrent during heavy rains.

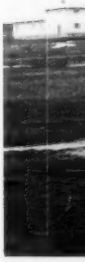
The tragedy is that most of these failures were unnecessary, had the builder only made use of soil information that was available or been aware of the changes urbanization often makes in local soils. The fact is that we have much land in the United States well suited to housing and industrial development, and that the limitations of the remainder can be identified and the problems anticipated.

New buildings and streets change the old relationships between soils and plant covers. Soils that were well drained under crops or native plants may become poorly drained, and even unstable, when a high percentage of the surface is overlain with houses and pavements. The remaining uncovered portions cannot take in all the extra water, so they become seasonally wet. Because of the greatly increased runoff, small streams may leap over their banks when heavy rains come.

Slopes are modified by making cuts and fills, changing not only their steepness but also the physical properties of the soils themselves. The new surface may be far less pervious than the original, either because plastic clay from lower layers in the soil has been added as fill or an

Water that falls on the roof now spills onto the garden (above), further taxing the soil's capacity to absorb rainfall. Because the house is built on a poorly drained soil (left), the septic tank filter field cannot operate and effluent comes to the surface.

This shopping center completely waterproofs 400 acres of former farmland.



Seasonally wet soils promise a nightmare rather than a dream for future home-owners.

original porous surface soil has been removed.

Results from gaging streams in watersheds before and after urban development, reported in U.S. Geological Survey Circular 554 by Luna B. Leopold in 1968, show that peak discharges of runoff more than double when 80 percent of the soil surface is made impervious and may increase 75 percent when half the area is affected. These peak discharges are increased further when paved storm drains are used for rapid disposal of runoff water. Urban watersheds with 80 percent of the area covered or graded and all of it served by storm drains, have had their peak discharges increased six times over the original rates.

Soil erosion and sedimentation increase at comparable rates with those of runoff as watersheds undergo urban development. Damages are most acute during construction of buildings and roads within the watershed. Intense rains on bare slopes and spoilbanks, with drains and waterways still unpaved, produce maximum runoff. Under such conditions, rates of sedimentation may increase 100 times; e.g., a watershed that produces 1,000 tons of sediment per square mile under farming or natural cover may produce 100,000 tons per square mile while under contruction—unless, of course, measures for runoff and erosion control have been applied.

Covering large parts of the soil surface may produce other serious hazards to the community. Increased wetness in some soils leads to slips that break foundations and roadways. If individual home sewage-disposal systems become swamped, the sewage effluent is likely to appear at the surface near the site or lower down the slope. And local runoff can increase enough to flood soils not previously subject to flooding.

Under gradual development some of these events do not happen im-

Buildings, roadways, and parking lots direct practically all rainfall into storm sewers.

mediately. In many communities, housing on well-drained soils immediately above the natural drainage way is safe until homes are built later at a higher level. When these soils become wet, increased runoff causes excess water to spill out on the older homes below them. If the new homes have individual sewage systems, the older homes may have their gardens contaminated.

Where winters are severe, in silty fine sandy soils, growing ice crystals fed by capillary upward movement of water may add to the instability of the soils and the structures on them.

We lack reliable estimates of the economic losses and dissatisfaction of homeowners and businessmen that result from failure to understand the hydrologic effects of construction and how to protect the land against them. Yet, from the experiences of people in the Soil Conservation Service consulted after such damages occur, we know that the annual loss is very large.

Obviously, both engineers and soil scientists must understand the principles involved. Hydrologic interpretations of soils used in forests and open fields may not apply where drastic changes have been made in soil use. Soil scientists, engineers, and plant scientists have unique opportunities to cooperate in evaluating the hydrologic effects that soil-use changes have on a watershed.

Engineers predict storm runoff in two ways:

(1) By making frequency studies of observed discharges from past runoff events and projecting future ones from the historical record. Such predictions are valid only so long as the watershed characteristics that prevailed when the past events occurred remained unaltered.

(2) By relating amounts of runoff for specific areas to amounts of rainfall. This method is used most commonly because data on rainfall

Increased surface runoff adds to ponding of a naturally wet site.

are more abundant than those on runoff.

Hydrologists predict runoff from rainfall by establishing the percentage of rainfall that is taken in by the soils and the percentage that runs off under specified conditions. The amount absorbed is a function of the soil characteristics, including slope, and the plant cover. The soil characteristics can be interpreted from the soil survey. They are expressed in a hydrologic grouping of kinds of soil.

This "synthetic hydrology" is used increasingly by engineers as more data become available through laboratory examination of the basic properties of named soils. Such knowledge helps avoid unexpected problems of flooding and sedimentation.

Several communities have proved that with good knowledge of the local kinds of soil, and their relationships to the local rainfall, runoff can be controlled. Urban development can be planned so that erosion and sedimentation are minimized during the construction period. This means holding sediment production within a range of 2,500 to 3,500 tons per square mile and having no buildings flooded during the heaviest rain of a 100-year frequency. In strictly rural areas where investments are low, designs can be made for floods of more frequent occurrence.

Urbanizing communities also need to give attention to the need for storing water to insure supplies for industrial and domestic use, including supplies for watering plants and cleaning streets. Traditional groundwater supplies cannot be depended on when rural areas are built up. Many of the permeable soil areas that contributed to ground-water recharge become paved or covered with buildings, cutting off or reducing the source of water in wells.

In several urban areas over the country SCS is assisting local officials in selecting suitable kinds of soil for roads and structures and in evaluating the hydrologic effects of suggested developments. Soil conservationists and specialists can suggest protective measures against excessive runoff, sedimentation, and property losses. SCS has worked with counties, cities, and towns in urbanizing communities around Newark, N. J.; Boston, Mass.; Atlanta, Ga.; Washington, D.C.; Chicago, Ill.; San Antonio, Tex.; San Diego, Calif.; southwestern Wisconsin; several communities in Michigan; and also many others.

These efforts have demonstrated that damages from erosion, flooding, and unstable soils, or serious deficiencies of water during droughts, can be anticipated. With an understanding of the relations between soils and water under changed conditions resulting from construction, appropriate plans for development can be made. ♦

Trace element studies link animal ailments with soils

By Joe Kubota
Research soil scientist, SCS, Ithaca, N. Y.

Studies of food-chain relationships continue to show that trace elements play significant roles in the health and growth of plants, animals, and humans.

The search for these relationships by nutrition and soil scientists at the U.S. Plant, Soil, and Nutrition Laboratory in Ithaca, N.Y., is leading beyond such familiar elements as cobalt and molybdenum to lesser known ones like cadmium and chromium.

Soil Conservation Service soil scientists are members of the research team at the Ithaca laboratory of the Agricultural Research Service. In addition to their work in the laboratory, they help to relate the findings to specific geographic areas through soil surveys that show where specific kinds of soils occur.

Changing emphasis

For several years, the veterinarians and plant and soil scientists have been studying the positive and negative effects of naturally occurring concentrations of cobalt, molybdenum, and selenium. Some well-known livestock "diseases" have been identified with excesses or shortages of these elements in their feed, and areas of problem soils have been mapped (see *Soil Conservation*, November 1965).

Cadmium and chromium are now receiving considerable attention as researchers try to determine how much of each gets into human food from the soil by way of plants.

Cadmium has been shown to be associated with hypertension in people residing in different parts of the country; it has also been blamed for reduced life span of experimental rats. A higher incidence of hypertension has been attributed to cadmium in polluted air, but little is known of its importance in soil-plant-animal chains.

Although most people think of chromium in connection with automobile trim, this metal is an important part of animal and human metabolism. It is now known to be an essential component of a "glucose tolerance factor" that animals normally require. Chromium also has been shown to help some patients with abnormal glucose metabolism who are in a diabetic-like state.

SCS soil scientists have helped others make effective use of maps prepared to show areas of trace-element concentration. Relationships among soils outlined in classification schemes provide a basis for selection of soil and sampling sites. Soils that have similar effects on the production of deficient or toxic plants are grouped together. Their distribution outlines problem areas where feed and forage may be harm-

ful or less nutritious for livestock.

Selenium provides a striking example of soil-related toxicity and deficieny symptoms in grazing animals. "Blind staggers," "alkali disease," and "dish-rag heart" describe toxic effects that have dominated biological interest in this element for many years. "White muscle disease" and other equally descriptive terms have been used to label selenium-deficiency symptoms. Both conditions are of major economic importance to stockmen in the United States.

A level of about 0.06 p.p.m. or more of selenium in forage plants is presently considered necessary for most grazing animals. If the ration contains more than 4 p.p.m. of selenium, some toxic effects may develop.

Although an animal's selenium requirement may be lower if the ration is high in vitamin E, this vitamin does not completely substitute for the element. There is strong evidence that selenium is an essential element for animals; but a selenium requirement for plants has not yet been established.

Areas in the United States where selenium is deficient in feed and forage crops have been identified. The distribution of low selenium shows good agreement with the reported incidence of white muscle disease.

White muscle disease is largely absent in the Great Plains States where soils with calcareous subsoils of high-selenium availability predominate.

Levels of selenium in milk and human blood show a geographic distribution pattern similar to that of selenium in forage plants. The role of selenium in human metabolism is not known; but since so many different animals are known to require this element, it seems likely that humans also need it. Today there is active interest and research underway in the medical profession. However, interregional shipments of human foodstuffs in the United States make it unlikely that people in this country would be subjected to selenium-deficient diets.

More on molybdenum

Like selenium, molybdenum and cobalt have been analyzed and related to various physiological expressions of shortage, adequacy, and excess. Even though molybdenum interferes with copper utilization, it is essential for both plants and animals. Cases of molybdenum toxicity in animals are recognized as molybdenum-induced copper deficiency or simply molybdenosis. No exact critical ratio of molybdenum to copper can be specified, but molybdenosis can be expected when molybdenum concentrations in forage plants exceed 10 to 20 p.p.m. Molybdenum is more toxic in fresh forage plants than in dried feed.

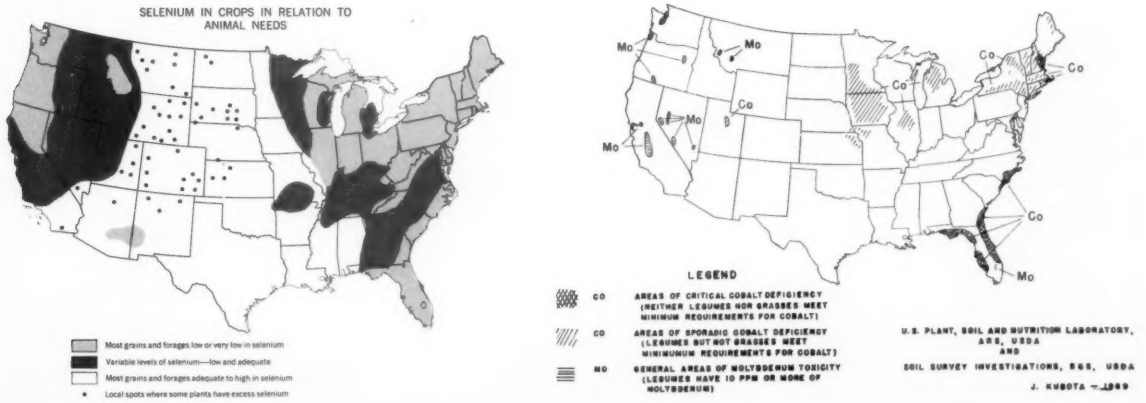
Molybdenum toxicity in grazing animals is primarily a problem in the Western United States. It is most often associated with neutral and alkaline soils on granitic alluvium of small streams. Since molybdenum is not readily available to plants on acid soils, they generally do not evoke symptoms.

Supplementary copper in salt or feed mixtures and subcutaneous injection of copper compounds are used to prevent molybdenosis. Copper fertilization of soils does not significantly increase concentrations in forage plants and is not a practical method of prevention.

Nutritional problems due to excess molybdenum are better known in this country than are problems due to excess copper. Cases of natural copper toxicities are rare here. In Australia, molybdenum is used to treat copper toxicity when it occurs in animals.

The distribution of high-molybdenum soil areas may be important to humans if observations relating molybdenum to good teeth can be substantiated in this country. It has been shown in New Zealand, England, and Hungary that children born and raised in areas of high molybdenum have better teeth (fewer decayed, missing, and filled)

Problem areas in animal nutrition due to lack or excess of trace elements in the soil: selenium (left), cobalt and molybdenum (right).


SELENIUM IN CROPS IN RELATION TO ANIMAL NEEDS
Most grains and forages low or very low in selenium
Variable levels of selenium—low and adequate
Most grains and forages adequate to high in selenium
Local spots where some plants have excess selenium
Mo
Co
LEGEND
AREAS OF CRITICAL COBALT DEFICIENCY (NEITHER LEGUMES NOR GRASSES MEET MINIMUM REQUIREMENTS FOR COBALT)
AREAS OF SPORADIC COBALT DEFICIENCY (LEGUMES BUT NOT GRASSES MEET MINIMUMUM REQUIREMENTS FOR COBALT)
GENERAL AREAS OF MOLYBDENUM TOXICITY (LEGUMES HAVE 10 PPM OR MORE OF MOLYBDENUM)
U.S. PLANT, SOIL AND NUTRITION LABORATORY, ARS, USDA
AND
SOIL SURVEY INVESTIGATIONS, SCS, USDA
J. KUBOTA —1969

than do children of comparable ages in low molybdenum areas.

Cobalt deficiency is a problem where forage plants lack enough to meet the needs of grazing animals. Ruminants require cobalt for vitamin B_{12} synthesis. The B_{12} produced in the rumen moves on in milk and meat to nonruminants and man.

Unlike animals, common plants do not have a specific cobalt requirement. But nodular bacteria of leguminous plants require very small amounts of this trace element to fix atmospheric nitrogen in soils.

Broad areas where legumes and grasses are low in cobalt occur primarily in the Eastern United States. In these areas, neither legumes nor grasses provide enough cobalt (0.07 p.p.m.) to meet animal requirements. In other parts of the United States, animals receiving substantial amounts of legumes are not subject to cobalt deficiency symptoms known to early settlers as "Chocorua's curse," "albany ail," and "neck ail."

Cobalt deficiency is primarily associated with Spodosols. In New Hampshire and southwestern Maine, Haplorthords formed in glacial drift derived from White Mountain granites inherited too little cobalt to maintain the cobalt levels in common forage plants. Similarly, the Humaquods inherited very small amounts of cobalt in the sandy Coastal Plain deposits. The Humaquods have the lowest amount of total cobalt (about 1 p.p.m.) of any soils in this country.

Grasses and feed grains rarely contain sufficient cobalt for cattle and sheep. Animals fed with rations that do not contain forage legumes must receive cobalt supplements in nearly all parts of the United States.

Cobalt supplements in salt or mixed feeds are commonly used to correct cobalt deficiency in cattle and sheep. Fertilization of the soil with cobalt is also used in some areas of the United States. In Australia, pellets containing cobalt are put into the rumen. ♦

Speedy soil survey meets needs of Long Island county

By Austin L. Patrick, Jr.
Area conservationist, SCS, Albany, N. Y.

New York's Long Island is shaped like a fish. It's head is composed of the New York City boroughs of Kings (Brooklyn to you) and Queens. Then comes Nassau County, small and urban. Most of its body, with its forked tail sticking away out into the Atlantic Ocean, is Suffolk County and, of course, the Suffolk County Soil and Water Conservation District. The county is best known for potatoes, ducks, and people.

Suffolk is an amalgam of agriculture, industry, and suburbia compounded by a very high population growth rate. Concerned about wise use as the land went from rural to urban, the Nassau-Suffolk Regional Planning Board in 1966 contracted with the Soil Conservation Service for a soil survey of 60 percent of Suffolk's 590,000 acres, the fieldwork to be completed by the end of 1969.

Immediate information

Land use was changing so fast, they said, that the information had to be available soon. To finance the accelerated project, including extra personnel, the planning board appropriated $30,000 supplemented by $60,000 from the Department of Housing and Urban Development.

The result is an unusually speedy soil survey utilizing SCS soil scientists from 10 states from Maine to Texas. Fieldwork progressed ahead of schedule so that by May 1969 the whole district was mapped. Additional local financing had made this possible after planning boards learned how useful the early soil information was to the development of the towns first mapped.

Leader of the soil survey party was John W. Warner, Jr., the only soil scientist assigned to work with the Suffolk County District full-time and paid wholly from SCS funds. His responsibilities for training and supervision were a major concern.

Twenty-eight soil scientists worked on the project, each spending 5 weeks to 3 months on the job. The number at any one time during the various details ranged from one to 16. They were most likely to be available from their regular assignments in the early spring and late fall.

The pleasures of mapping

Warner conducted 1-week orientation sessions for team members. Since all were professional soil scientists, they needed only to become familiar with local soils.

Ray Marshall, New York state soil scientist for SCS, says that the quality of the work is excellent.

Last fall, Warner working with Thermon Sanders from Michigan and Alan Ford from Texas did some of their most enjoyable mapping—on the offshore islands. These included Gardiners Island, owned by one family since it was received as a King's Grant and now used primarily as a private hunting preserve; Plum Island, the USDA animal disease research center; and Fishers Island, a resort island closer to Connecticut than to New York.

Island mapping brought two unusual experiences. Once the team had to stay on a lonely island until dark, since the police boat which ferried them was busy during the daylight hours seeking an escaped bank robber. Another time 15-foot waves made a very rough trip in the 30-foot boat. Warner said, "I

began to wonder how New York could explain to Texas and Michigan that their soil scientists were lost at sea while on duty."

Facts at work

Soil scientists who volunteered for the Suffolk project say that for the most part they wanted to broaden their experience. One man from Vermont said the longer mapping season helped to prevent "cabin fever." Another said he worked alone most of the time, and the Long Island job enabled him to rub elbows with fellow soil scientists.

While publication of the soil survey is still in the future, the information is now being used by the Nassau-Suffolk Regional Planning Board. The town of Brookhaven let a contract to revise the land use section of its master plan, to be based on the survey. The town of Southold is making some land use and zoning laws based on results of soil interpretations.

Such is the demand for SCS assistance that a signed memorandum of understanding between one town and the Suffolk County District was delivered by police car to the district board during its June meeting. ♦

A new clover that lasts longer

By Thomas A. Bown
Plant materials specialist, SCS, Jackson, Miss.

A new clover may contribute $300,000 to the economy of Arkansas, Louisiana, and Mississippi. A new late-maturing clover has been found to help bridge the forage gap between cool-season and warm-season plants.

Meechee arrowleaf clover, a reseeding winter annual, was evaluated by the SCS plant materials center at Coffeeville, Miss., and jointly released in 1966 by the Soil Conservation Service and the Mississippi Agricultural Experiment Station.

Meechee has been tested and found to be adapted to all of Arkansas, Louisiana, and Mississippi. It is a cold tolerant, high forage producing, reseeding winter annual that can be used to overseed warm-season grass pastures for spring forage production. The use of this clover can result in a resource that did not previously exist. Because it is late maturing, Meechee arrowleaf clover produces most of its forage after crimson clover has seeded out and before the warm-season forage plants have produced much growth.

Meechee clover begins its growth in late March or early April, depending on the location and the season. It can be grazed from mid-April to late May. The cattle should be removed to allow the plants to set a good seed crop, then the pasture can be grazed the rest of the summer.

The Meechee arrowleaf clover plantings in the three states had increased to about 2,500 acres by 1968. During the summer of 1968, approximately 80,000 pounds of Meechee seed was harvested from 350 acres.

Conservative estimates indicate that the forage from an acre of Meechee arrowleaf clover will produce 100 to 125 pounds of beef. If it is assumed that all of the 80,000 pounds of Meechee arrowleaf clover seed produced in 1968 were planted, there would be 8,000 acres in production in the spring of 1969. The projected value of the forage from these pastures, when converted to beef, would be $240,000 to $300,000. This is more than half the total cost of operating the Coffeeville Plant Materials Center from its beginning in 1961. ♦

Meechee arrowleaf clover in full bloom (left) and earlier in the season (right) shows its high-producing capability.

Conservation in action . . .

Irrigation ditch saves soil, water

Montana

A consolidated irrigation ditch in the Gallatin Valley Soil Conservation District, Mont., reduces sedimentation in the Gallatin River while it provides dependable water supply for many small farm operators near Bozeman.

Last year members of the Severns, Tudor, and Beck-Border ditch groups decided to replace three aging structures with a new canal designed by the Soil Conservation Service, rather than attempt to repair the old headgates. Before consolidation, irrigation water had been diverted from the West Gallatin River with temporary dikes of gravel, straw bales, or logs.

Before enlarging the Beck-Border ditch, the three groups obtained legal counsel from a local law firm to protect water rights and to get property easements. They also signed a pooling agreement with the Agricultural Stabilization and Conservation Service for cost-sharing under the Agricultural Conservation Program.

Plans for ditch consolidation called for brush clearing, bank smoothing, grass seeding, and new construction. A road on one side of the Beck-Border canal makes maintenance easier. A concrete headgate and diversion structure replaced the old headgates and gravel dike.

Contracts for the $12,000 job were let separately. One contractor handled tree removal; another seeded grass and built the structures. A third constructed the concrete diversion and headgate—KENNETH HARMAN, *district conservationist, SCS, Bozeman, Mont.*

Nebraska

Conservation supervisors practice what they preach

District supervisors of the Sheridan County Soil and Water Conservation District, Nebr., raise interest in the Great Plains Conservation Program as well as cattle and wheat.

"First you establish a Great Plains Program on your own place. Then you can talk to neighbors about conservation—not the other way around," District Supervisor Charley Letcher says. He and the other board members set an example with this record of work completed under contract:

Grass seeding on 1,400 acres; 52 miles of terraces; 24 dams; proper grazing on 15,000 acres; crop residue management on 2,100 acres, and 10 wildlife windbreaks.

Plans to improve commercial operations include provisions for wildlife production and recreation. Pheasant population is high on all of the supervisors' ranches; deer and wild turkeys are especially plentiful on the ranches of Supervisors Frank Krotz and Herman Jungck.—WILFRED J. STUART, *district conservationist, SCS, Rushville, Nebr.*

Colorado

Sewage lagoons aid school opening

When difficulties with onsite sewage disposal threatened to prevent the opening of two schools in Mesa County, Colo., last fall, the county health department turned to the Soil Conservation Service for aid in solving the problem.

Onsite soil investigations at Gateway and Beaver Creek schools indicated that disposal through filter fields could not function properly because of severe soil limitations. Sewage lagoons appeared to be the most practical and least costly of the methods available.

Soil conditions at the Beaver Creek School were almost perfect for a sewage lagoon, so the facility was designed not only for the school but for the community near the

One of the old gates . . .

and one of the new ones.

Rajah Uranium Mine as well.

The soils at the Gateway School, however, were stony and cobbly and created problems. The only potential site was on the opposite side of West Creek and would require bentonite or other material to seal the lagoon.

The soil survey showed there was no suitable material locally, but a bed of bentonite on public land near Grand Junction could supply the sealant. The Bureau of Land Management granted a free use permit, and a small fee was charged for hauling the bentonite.

Thus the onsite sewage disposal problem for the schools was solved with the cooperation of local, state, and federal agencies.—CLAYON F. SPEARS AND JOHN C. DIXON, *soil scientist and district conservationist, SCS, Grand Junction, Colo.*

Indiana

Comfortable camping by a multipurpose lake

A dream came true for Sullivan County, Ind., when recreation facilities around its 461-acre flood-prevention structure were ready for weekend sailors, picnickers, and campers.

Picnic areas, boat docks and mooring, a launching ramp, and an ample beach line the shores of Sullivan County Lake, one of 26 structures in the Busserson Watershed Project sponsored jointly by the conservation districts of Sullivan, Greene, Vigo, and Clay counties.

The Busserson Conservancy District was created to administer the works of improvement in the project, and the Sullivan County Park and Recreation District took over the development and operation of the recreation facilities. The Indiana Department of Natural Resources has seen to it that fishermen enjoy good catches by stocking and managing fish habitat.

Beside the lake, there are 180 units for tenting and trailer camping and also a group camping area for roughing it. Blacktopped roads and trailer pads minimize dust. City water and sewage lines, telephones, and electricity provide some of the essential comforts for campers' homes away from home. Concession stands, a beach house, and a trailer service center were also built on the 420-acre tract.

A hard-working board of directors put in many hours on the County Park and Recreation District's project. Thanks to their efforts and assistance from the Sullivan County Commissioners, the County Council, Farmers Home Administration, Extension Service, Busserson Conservancy District, SCS, and local citizens, Sullivan County has one more feature to attract industry, commerce, and homeowners. — DONALD V. WILSON, *district conservationist, SCS, Sullivan, Ind.*

New Mexico

Improvement of rangeland curbs erosion, grows beef

Cattle put on more weight while wind removes less soil from C. H. Fulfer's ranch near Mountainair, N. Mex., in the Claunch-Pinto Soil Conservation District.

Cropland conversion and a rotation-deferred grazing system have boosted weaning weights from an average of 350 pounds in 1960 to around 480 pounds. Also, carrying capacity of Fulfer's improved rangeland increased from 12 to 16 animal units per section.

Fulfer has participated in the Great Plains Conservation Program since 1959. At one time, 2,000 acres of his land was in beans. Last year, he reseeded the last 100 acres of former cropland on his ranch. Blue grama, Vaughn sideoats grama, and western wheatgrass provide dependable, nourishing cover.

Fulfer has built pit tanks, fences, and livestock water wells to relieve grazing pressure around old watering places. He also installed miles of plastic pipe to distribute water in six pastures. He cleared brush on 531 acres, but he has left pinon and juniper on slopes and gullies for deer, antelope, quail, rabbits, and other wildlife.—JOHN WERNER, *district conservationist, SCS, Roswell, N. Mex.*

Turkeys on Sheridan County ranch.

A cooperative recreation development.

Cooperation curbs erosion in interstate RC&D Project

By Robert A. Speich
RC&D Project coordinator, SCS, Princeton, W. Va.

Highway department officials of two states are helping local people stabilize and beautify roadbanks and mine spoils in an Appalachian Resource Conservation and Development Project.

Last year, in a cooperative venture with the Mountain Dominion RC&D Project, the West Virginia State Road Commission and the Virginia Department of Highways supplied men and machinery needed to seed 74 acres of bare roadbanks in the five-county project area.

Technical assistance and materials were provided by the RC&D Project in two West Virginia counties (Mercer and Summers) and three Virginia counties (Bland, Tazewell, and Giles). Tall fescue, sericea lespedeza, and crownvetch are now holding on slopes of 45° or more.

Special ACP funds

Special Agricultural Conservation Program funds totaling $6,500 have been allocated for land treatment in the Wolf Creek watershed (Summers) and the East River watershed (Mercer). Sediment control is one phase of a 14-section effort to improve environment in the East River watershed. Extra funds for roadbank stabilization will come from the Princeton and Bluefield Garden Councils.

Twenty-seven acres of roadbanks in the nearly completed Brush Creek Watershed Project (W. Va.) will be hydroseeded this year with State Road Commission equipment.

Mine-spoil stabilization

Strip-mine spoil in Mercer County will be seeded to a mixture of black locust, fescue, lespedeza, and ryegrass by the Southern Soil Conservation District under contract with the surface-mining company involved. The district will furnish men, materials, and equipment for work needed on 350 acres.

Bill Roller, Virginia Commissioner for the Division of Mined Land Reclamation, reports that 121 acres of strip-mine spoil near Boissevain and Shorts Gap (Tazewell County) was reclaimed in 1968. One hundred acres was hydroseeded; the rest was done by hand. Under a 1966 Virginia reclamation law, about 202 acres expected to be distributed by permit holders during 1969 will be slated for revegetation in 1970.

Landowners in Giles, Bland, and Tazewell counties are also participating in the silt reduction campaign with the aid of the Appalachian Land Stabilization and Conservation Program. Each may have up to 50 acres of land treated with any planned and needed conservation practice under this program administered by the Agricultural Stabilization and Conservation Service. Efforts are being made to extend similar assistance to the West Virginia counties. ♦

Southern District crew plants outer slope of a strip-mine spoil area.

Crew uses hydroseeder belonging to Southern Soil Conservation District to spray seed and fertilizer on mine spoil.

Meetings . . .

Societies discuss agronomy and soils

The annual meeting of the American Society of Agronomy, Soil Science Society of America, and the Crop Science Society of America will be held in Detroit November 9-14.

"Agronomy and Health" will be the general theme, and a diverse program has been developed around this topic. Special symposia and other sessions are being planned by the Agronomic Division, Crop Science, and Soil Science members. Some of the symposium topics include "Aerospace Science and Agricultural Development;" "Production, Transport, and Metabolism of Photosynthate in Crop Plants;" "Laboratory Methods for Varietal Characterization;" "Water Utilization by Turfgrasses;" and "Graduate Teaching in Soils."

Tours planned are: Visits to the Michigan State University turfgrass research plots and facilities; Willow Run laboratories to view instrumentation for accumulating and analyzing remote sensing observations; Port of Detroit; southeastern Michigan to see examples of soil-land use relationships and the Macomb County Planning Commission; and to a dairy and truck farming area and to view hot house rhubarb and mushroom production.

Grange plans for new rural businesses

National Grange will hold its annual meeting November 10-19 in Daytona Beach, Fla.

Among other things, this organization will discuss ways to improve the economic facilities of rural America. Many of the people in rural areas are no longer active farmers but still live in smaller communities. Ways are being planned to bring in new business in these areas to supplement the income of these people.

Seed Conference aims at research-marketing

The 15th Annual Farm Seed Conference will be held on November 5 in Kansas City, Mo., following the annual convention of the Western Seedsmen's Association on November 2-4.

The theme, "Research-Marketing," aims at projecting a panoramic review of the latest information available on present and future research; and on marketing of farm seeds.

Dates and places

November 2–4, Western Seedmen's Association, Kansas City, Mo.
9–12, National Association of State Universities and Land Grant Colleges, Chicago, Ill.
9–12, National Forest Products Association, Boca Raton, Fla.
9–14, American Society of Agronomy, Detroit, Mich.
9–14, Soil Science Society of America, Detroit, Mich.
10–12, Geological Society of America, Atlantic City, N. J.
10–19, National Grange, Daytona Beach, Fla.
24–Dec. 1, General Assembly International Union for the Conservation of Nature, New Delhi, India.
December
1–5, National League of Cities, San Diego, Calif.
2–5, Western Forestry and Conservation Association, Spokane, Wash.
3–5, Congress of American Industries, NAM, New York, N. Y.
8–11, American Farm Bureau Federation, Washington, D. C.
9–11, Annual Corn and Sorghum Research Conference, Chicago, Ill.
9–12, American Society of Agricultural Engineers, Chicago, Ill.
26–31, American Association for the Advancement of Science, Boston, Mass.
27–30, American Agricultural Economic Association, New York, N. Y. ♦

Functions of SCS plant material centers

SCS plant materials centers have three functions: (1) To assemble, evaluate, select, and increase grasses and legumes for use in soil and water conservation; (2) to determine reliable cultural and management methods for their use; and (3) to get proved materials into production by farmers, ranchers, and commercial growers. ♦

Review

Design with Nature. By Ian L. McHarg. *1969. Natural History Press, Garden City, N.Y. 214 pp., illus.: 11 x 11 in. $19.95.*

The emergence of Ian McHarg, a salty Scot, as new high priest of ecology, conservation, and land use planning, is most easily understood after reading *Design with Nature,* his man-sized book of king-sized concepts, collected, he admits, "in a rag-bag of memories and assembled in a patchwork quilt."

Writing pungently as a multi-faceted Harvard scholar, architect, urban planner, educator, naturalist, world traveler, and scientist, Dr. McHarg describes his book as "a personal testament to the power and importance of sun, moon, and stars, and changing seasons, seedtime and harvest, clouds, rain and rivers, the oceans and the forests, the creatures and the herbs . . . (our) co-tenants of the phenomenal universe."

Without doubt, it is a very important book—perhaps the best exposition available to professional soil conservationists studying multiple land use, inventory, planning, and potential.

Much of what McHarg says in his book is identical to advice that humble conservationists from SCS have been dispensing for years—namely, leave trees on steep slopes, keep subdivisions out of flood plains, use good agricultural land for agricultural purposes. The major difference between McHarg and the SCS fellows over at the courthouse is that he holds a world-view with significant metaphysical implications.

For McHarg, and others, the problems of man's survival are rapidly approaching cataclysmic dimensions. With impassioned language, he pleads for sanity in using the resources at hand while lashing the "uglifiers whose ignorance, stupidity, and greed have produced our

scabrous towns, raped land, filthy air, pathetic subdivisions, derelict industries, and befouled rivers."

He alternates chapters of theoretical, but never idle, discussions with how-it-was-done accounts of case studies in specific geographic areas, such as the Potomac Basin, New Jersey shore, and Manhattan area. Some solutions are offered, but if area planners want the full story they can retain his prestigious Philadelphia architectural firm.

Despite structural flaws in the book and numerous difficult-to-read passages, McHarg succeeds memorably in portraying vast inescapable conservation problems that must receive immediate attention if civilization is to survive.—PERRY FLIPPIN, *Information Division, SCS.*

Audio-visuals

The Soil Conservation Service has revised its color slide set, "Know Your Land," an introduction to the soil capability classification system used by soil conservationists and farmers.

The set, No. C-8, containing 50 slides and an illustrated narrative guide is available for $8.00 from Photography Division, Office of Information, U.S. Department of Agriculture, Washington, D.C. 20250.

It is also available as a filmstrip for $5.50 from Photo Lab, Inc., 3825 Georgia Avenue, N.W., Washington, D.C. 20011.

Other slide sets produced by SCS and available at the above addresses include:

To Save Our Land. *1967. No. C-141. 48 frames. Slide set $8.00, filmstrip $5.50.* A general history of SCS from the early thirties to the present time.

Watershed Projects for Protection and Profit. *1966. No. C-128. 55 frames. Slide set $9.00, filmstrip $6.50.* An introduction to the small watershed program (Public Law 566) and how projects are developed for flood prevention, recreation, municipal water supply, etc.

America The Beautiful. *1961. No. C-77. 52 frames. Slide set $9.00, filmstrip $6.50.* A slide set of the America The Beautiful series showing the beauty of rural America. A representative scene from each state plus Puerto Rico and the Virgin Islands is included.

New Publications

Natural Resources of Minnesota. *1969. U. S. Dept. Interior. 46 pp., illus. $0.60.* Twenty-second in a series of reports on the natural resources of the states, this one presents the historical heritage of the North Star State. Minnesota serves as the northern gateway to the West, is one of the great dairy states, and ranks second only to Wisconsin in milk production. Livestock and livestock products provide the greatest income to farmers, and grains are also a great source of income. The potential wealth of Minnesota's forests and mineral production are immense. Her more than 15,000 lakes and the Mississippi River and its tributaries provide water for power and these water resources together with much recreation parkland make her a year-round vacationland. The Forest Service, U. S. Army Corps of Engineers, and Soil Conservation Service contributed to the booklet.

Flow and Retention of Water in Layered Soils. BY D. E. MILLER. *1969. USDA Conservation Research Rpt. 13. 28 pp., illus. $0.25.* The principles of water retention in layered soil were developed in laboratory studies, with model and field profiles, and by numerical techniques. In terms of the conventional available water, a layered soil will hold 50 to 60 percent more available water than will a similar depth of uniform soil. The amount of water held by a layered soil increases as the underlying particles become coarser and is greatest adjacent to the soil-layer interface. It decreases with elevation above the layer.

Water and Wastewater Technology. *1968. U. S. Dept. of Health, Education, and Welfare and U. S. Dept. of Interior Technical Education Program Series 11. 131 pp., illus. $1.50.* Aid to vocational educators and other interested persons and agencies to plan urgently needed water and wastewater technology programs, or evaluate existing ones, by offering a suggested 2-year post high school curriculum and course outlines. Also supplies information on technical education procedure, facilities, equipment and costs, texts and references, and scientific and technical societies.

Summary of Reservoir Sediment Deposition Surveys Made in the United States Through 1965. COMPILED BY F. E. DENDY AND W. A. CHAMPION. *1969. USDA Misc. Publ. 1143 64 pp., illus. $0.65.* Supersedes and updates Miscellaneous Publication 964 of the same name through 1960. It repeats all reservoir surveys reported in No. 964 and includes unreported surveys made before 1964, new data on reservoirs surveyed or resurveyed since 1960, and some information on debris basins. The reservoirs are located in all of the 48 states, except Maine and Florida, and in Puerto Rico. The table gives for each reservoir the average annual sediment accumulation per square mile of drainage and related data. A supplement to the bulletin gives detailed data for each reservoir.

Annual Lespedezas, Culture and Use. BY P. R. HENSON AND W. A. COPE. *1969. USDA Farmers' Bull. 2113. 16 pp., illus. $0.15.* Superseding Farmers' Bulletin 1852, *Lespedeza: Culture and Utilization,* and Leaflet 240, *Kobe, A Superior Lespedeza,* describes the two species of annual lespedeza, *Lespedeza striata* (striate) and *L. stipulacea* (Korean), and their use.

Sudangrass and Sorghum-Sudangrass Hybrids for Forage. *1969. USDA Farmers' Bull. 2241. 12 pp., illus. $0.15.* Superseding Farmers' Bulletin 1126, *Sudan Grass,* describes the grass and varieties and gives information on preparation and harvesting of the grass and table listing the common pests and their control.

Products of American Forests. By F. J. CHAMPION. *1969. USDA Misc. Publ. 861. 30 pp., illus. $0.50.* Lists the many uses of the wood products and wood chemical products.

Fishing in the National Park System. *Rev. 1969. U. S. Dept. of Int. 16 pp; map. $0.30.* A listing of the parks, their addresses, and fishing resources.

Soil surveys

Lake County, Tennessee. BY WILLIAM T. BROWN, W. C. JACKSON, G. L. KEATHLEY, AND C. L. MOORE. *1969. 39 pp., illus.; maps 3.17 inches to the mile (1:20,000).*

Montgomery County, Illinois. BY C. E. DOWNER AND R. T. ODELL. *1969. 94 pp., illus.; maps 4 inches to the mile (1:15,800).* Fieldwork by C. E. Downey, R. L. Allison, F. N. Carroll, D. R. Grantham, D. B. Phillips, B. J. Weiss, R. F. Wicks, R. H. Andersen, J. B. Fehrenbacher, C. J. Frazee, P. R. Johnson, C. D. Sopher, and L. P. Wilding.

Plymouth County, Massachusetts. BY CHARLES W. UPHAM. *1969. 116 pp., illus.; maps 3.17 inches to the mile (1:20,000).* Soil surveyed by Charles W. Upham, Rino J. Roffinoli, and Carl B. Newsome.

Washabaugh County, South Dakota. BY ROBERT E. RADEKE. *1969. 62 pp., illus.; maps 3.17 inches to the mile (1:20,000).* Soils surveyed by John Foreman, Edward Bookless, Rex L. Carey, Richard Krueger, Roy Lembke, Jack Safford, and Albert Thurman.

From the Administrator:

Service in the seventies

In September, I met with our 50 state conservationists near Jackson, Wyo., in the magnificent setting of the Grand Tetons, to think and talk about the role of the Service in the seventies.

To provide a base for the week's effort, I asked our conservationists to study carefully the work we are doing now and to give me their best thinking on which activities need expanding, which need changing, and which should be curtailed or abolished.

"The more of a sacred cow an operation is," I reminded them, "the more it probably needs a critical review."

I also asked them to take a hard look at the many new areas in which the Service is being called upon to give technical assistance —help to planning and zoning commissions, pollution control authorities, land developers and tax assessors, and so forth.

"Let's try to define the most useful contributions we can make in each of these areas," I said, "keeping in mind that changes already underway in America are likely to accelerate in the decade ahead."

For the next 3 days, the state conservationists were divided into four working parties, each organized to reflect a cross-section of the whole country.

The comments and recommendations which emerged from those sessions cover many pages, and they include minority views as well as majority views. Little would be served by making them public in their entirety; they are internal documents for my use and the use of my staff. But it is possible at this time to indicate some of the main directions in which the thinking of our conservationists headed.

- Most state leaders foresaw increased demand for resource planning assistance to groups, communities, areas, and regions, and they said we had better gear up now, with better training, more specialists, and more efficient procedures to deal with this challenge of the seventies.
- They predicted an increasingly broad role for the Service in the field of pollution abatement and environmental improvement.
- They called for more accurate information on sources of sediment and the effect of sediment-control measures.
- They suggested seeking a substantial increase in assistance from non-Federal sources, like contractors, conservation districts, and landowners.
- They had nothing but praise for the NACD District Outlook approach and thought the Service should encourage and assist districts in meeting District Outlook goals.
- They felt that the Service should continue to lead in the design and application of sound technology for planning and installing conservation and resource development programs. Again, they called for updated training and specialists in new fields, like sanitary engineering, ecology, and landscape architecture.
- They gave strong backing to an intensified Service information program to explain our activities to all Americans. They also endorsed increased support for conservation education activities.

Finally, they called for a national long-range program for the Service; some said for the seventies, some called for an even longer-range plan. But there was general agreement that the Service needs to establish its goals and objectives clearly and to set forth a program to meet those objectives and goals.

It was an excellent meeting and one which gave me a great deal of personal satisfaction.

Kenneth E. Grant

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Soil survey benefits in millions to urban communities

Paul F. Saint (left), chairman of the Needham Board of Selectmen; Everett L. Francis of SCS; and Thomas Quarles, chairman of the Needham Conservation Commission, inspect sample of underlying soil.

Soil survey benefits to Massachusetts communities are in the millions of dollars.

And Needham, like many other towns in Massachusetts, is having a soil survey made to help assess soil, water, and related natural resources and to pinpoint projects for immediate action. Activities in Needham are typical of what many of the Commonwealth's communities are doing. This town completed a master plan in 1966. Needham's soil survey and a later natural resources inventory will provide basic information to improve the town's overall comprehensive plan.

The town is sharing the cost for its survey with the Soil Conservation Service through arrangements for this technical help by the Norfolk Conservation District.

The soil survey report will include a description of all of the soils in the town (i.e., township) with maps showing their location. Interpretations are made for a wide variety of urban uses.

These interpretations, setting forth limitations for home, school, and commercial and industrial sites, and for septic tank sewage disposal, deal primarily with building and construction operations. Information on limitations for agricultural use, woodlands, and for wet-land wildlife sites are also given.

Interpretations are made for other uses, including highways, athletic fields, sanitary landfill, cemeteries, and installation of water and sewer lines. Several interpretations provide general information showing depth of seasonal highwater table, land slope, surface runoff, and sources of sand and gravel. Each town decides what soil interpretations are most needed.

Many Massachusetts towns and communities have cost-shared with SCS for a soil survey with urban interpretations over the last few years. Seventy-five of Massachusetts' 351 communities have received soil survey reports covering more than a million acres. Ten towns are being mapped this field season. During the past few years, about 85 percent of the time of SCS soil scientists in the Commonwealth has been devoted to soil surveys for towns.

Big savings to Massachusetts communities are resulting from these surveys. More accurate information is available to solve project problems and as a basis for cost determinations. Some projects that might otherwise have been doomed to failure are not being started. A recent canvass showed realized benefits of $175 for every dollar of survey costs.—WILLIAM H. COATES, *assistant state conservationist, Amherst, and* ROBERT N. MOREHOUSE, *district conservationist, SCS, Acton, Mass.* ♦

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